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REMARKS

This is a full and timely response to the non-final Official Action mailed **June 19, 2007**. Reconsideration of the application in light of the following remarks is respectfully requested.

Request for Continued Examination:

Applicant hereby requests Continued Examination for this application and entry and consideration of this amendment consequent thereto.

Claim Status:

Various claims have been amended by the present paper. No claims are added, claims 57 and 60 has been cancelled without prejudice or disclaimer.

Claims 5 and 31 are withdrawn, but will be entitled to rejoinder upon allowance of the respective independent claims. MPEP § 821.04.

Claims 32-34 and 40-56 have been cancelled previously without prejudice or disclaimer. Consequently, claims 1-4, 6-30, 35-39, 58, 59 and 61 are currently pending for further action.

35 U.S.C. § 112, First Paragraph;

The recent Office Action rejected claim 3 under the written description requirement of 35 U.S.C. § 112, first paragraph. (Action of 6/19/07, p. 2). In response, claim 3 has been amended herein to recite "a cathode air profiling manifold disposed around said fuel cell stacks such that an air flow to said fuel cell stacks is *optimized* by said air profiling manifold." (Emphasis added).

Support for this amendment to claim 3, including the required written description under § 112, first paragraph, can be found in Applicant's originally-filed specification at, for example, paragraph 0031. Therefore, following entry of this amendment, the rejection under § 112 of claim 3 should be reconsidered and withdrawn.

Prior Art:

Claims 1-4, 6, 7, 10-13, 16-23, 35 and 57-61 were rejected as being unpatentable under 35 U.S.C. § 103(a) over the combined teachings of U.S. Patent No. 5,480,738 to Elangovan et al. ("Elangovan") and U.S. Patent App. Pub. No. 2006/0257302 to Deshpande et al. ("Deshpande"). For at least the following reasons, this rejection is respectfully traversed.

Claim 1 recites:

> An integrated fuel cell stack and catalytic combustor apparatus, comprising:
> a fuel cell stack assembly having multiple fuel cell stacks between which is defined a cavity;
> each of said fuel cell stacks including a plurality of individual fuel cells; and
> a catalytic combustor disposed at least partially within said cavity *and between adjacent fuel cell stacks*, said catalytic combustor having a catalytic bed and a catalytic igniter, wherein said catalytic combustor is configured to receive and combust excess exhausted fuel from said fuel cell stacks;
> *wherein a flow of reactant through said fuel cell stacks is in a direction counter to a direction in which said excess exhaust fuel flows to said catalytic combustor such that a heat generation profile in said catalytic combustor is opposite that in said fuel cell stacks such that operation of said catalytic combustor normalizes a temperature profile along a length of said fuel cell stack assembly.*

(Emphasis added).

Independent claim 19 recites:

> An integrated fuel cell stack and catalytic combustor assembly, comprising:
> a frame;
> a fuel cell stack assembly comprising multiple fuel cell stacks coupled to said frame, said fuel cell stack assembly having opposing fuel cell stacks between which is defined a cavity;

> each of said fuel cell stacks including a plurality of individual fuel cells each having an anode, a cathode, and an electrolyte; and
>
> a catalytic combustor disposed at least partially within said cavity *between adjacent fuel cell stacks* such that a fuel channel is defined in a space between said catalytic combustor and said fuel cell stacks, and wherein said catalytic combustor includes a catalytic bed and a catalytic igniter, wherein said catalytic combustor is configured to receive and combust excess exhausted fuel from said fuel cell stacks;
>
> *wherein a flow of reactant through said fuel cell stacks is in a direction counter to a direction in which said excess exhaust fuel flows to said catalytic combustor such that a heat generation profile in said catalytic combustor is opposite that in said fuel cell stacks such that operation of said catalytic combustor normalizes a temperature profile along a length of said fuel cell stack assembly.*

(Emphasis added).

Support for the amendments to claims 1 and 19 can be found in Applicant's originally filed specification at, for example, paragraph 0033.

Applicant wishes to note that claims 1 and 19 recite a catalytic combustor disposed at least partially in a cavity that is defined *between* adjacent fuel cell stacks of a stack assembly. The combustor receives excess fuel exhausted from the fuel cell stacks, "wherein a flow of reactant through said fuel cell stacks is in a direction counter to a direction in which said excess exhaust fuel flows to said catalytic combustor." (Claims 1 and 19).

The counter-flow arrangement (Applicant's specification, paragraph 0033), provides a particular advantage that is unrealized in the prior art. Applicant's specification explains that fuel cell stacks can suffer from fuel depletion effects that produce a temperature gradient along the fuel cell stacks.

> The temperature gradient is typically characterized by a hottest end at the fuel entrance with temperature decreased away from the fuel entrance to the lowest temperature in the gradient at the exit end. A heat generation profile is created by the gradient combustion. This heat generation profile establishes a gradient temperature profile in the fuel cell stacks. If allowed to persist, this temperature gradient may contribute to a decreasing power production profile of the individual fuel cells along the length of the fuel cell stack assembly in the flow direction. In the [Applicant's claimed] process, the temperature gradient of each of the fuel cell stacks is normalized (step 570). By "normalized," it is meant that the temperature or temperature profile is made more uniform along the length of the fuel cell stack assembly. This normalization may be accomplished by combusting the unutilized fuel and remaining excess cathode air in

> the catalytic combustor. This combustion is done in a counter-flow arrangement thereby creating a heat generation profile in the catalytic core opposite to that established by the electrochemical reaction (step 560).

(Applicant's specification, paragraph 0033).

Consequently, claims 1 and 19 specifically recite a flow of reactants to the fuel cells in a direction counter to that in which excess exhaust fuel flows to the catalytic combustor, which results in "a heat generation profile in said catalytic combustor [that] is opposite that in said fuel cell stacks such that operation of said catalytic combustor normalizes a temperature profile along a length of said fuel cell stack assembly." (Claims 1 and 19).

None of this subject matter is taught or suggested by the prior art of record.

Firstly, the combination of Elangovan and Deshpande fails to even teach or suggest a catalytic combustor that is disposed with a cavity "between adjacent fuel cell stacks." As discussed on the record previously, Elangovan teaches a fuel reformer (46). As explained in Elangovan, a fuel reformer is used to prepare fuel prior to consumption by a fuel cell. "Fuel reformation involves chemical conversion of a portion of the fuel from the difficult to react larger molecules and species to more electrochemically reactive chemical species. Accordingly, the fuel cell reaction is facilitated and the efficiency of the fuel cell is enhanced." (Elangovan, col. 3, lines 61-67). Consequently, the reformer (46) taught by Elangovan is upstream from the fuel cell stacks and, as shown specifically in Fig. 1, is arranged outside the fuel cell stacks (14, 16), *not* in a cavity between adjacent fuel cell stacks as claimed.

Deshpande similarly teaches a combustor (20) that work with a fuel processor (30), like Elangovan's reformer, to prepare a fuel for a fuel cell (40). (*See*, Deshpande, Fig. 1). As pointed out in the Office Action (Action of 6/19,/07, p. 11), Deshpande further teaches that the "combustor of the present invention has a number of functions including the generation of heat to pre-heat reformer reactants, the generation of steam for use in the reforming reaction, and *the disposal through oxidation of various fuel cell exhaust gases*." (Deshpande, paragraph 0021 and (45) in Fig. 1).

However, Deshpande does not ever teach or suggest that the combustor (20) is disposed in a cavity between adjacent fuel cell stacks. To the contrary, Fig. 1 of Deshpande appears to suggest that the combustor (20) is wholly separate from the fuel cell (40), with the fuel processor (30) being disposed between the two.

Consequently, the cited prior art fails to teach or suggest the claimed combustor that is "disposed at least partially within said cavity and between adjacent fuel cell stacks."

Moreover, neither reference teaches or suggests that "a flow of reactant through said fuel cell stacks is in a direction counter to a direction in which said excess exhaust fuel flows to said catalytic combustor such that a heat generation profile in said catalytic combustor is opposite that in said fuel cell stacks such that operation of said catalytic combustor normalizes a temperature profile along a length of said fuel cell stack assembly." There is absolutely no teaching or suggestion in the prior art of record of this subject matter.

In an alternative rejection, claims 1-4, 6-7, 10-13, 16-23, 35 and 57-61 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of Elangovan and U.S. Patent App. Pub. No. 2003/0157002 to Andel et al. ("Andel"). This rejection is respectfully traversed for essentially the same reasons given above.

As demonstrated above, Elangovan does not teach or suggest the claimed combustor "disposed at least partially within said cavity and between adjacent fuel cell stacks." Like Deshpande, Andel similarly fails to teach or suggest this subject matter.

In this regard, the Office Action cited Andel at claim 4. (Action of 6/19/07, p. 19). Claim 4 of Andel reads as follow: an apparatus "being part of a fuel cell system, wherein an after burner for the hydrogen containing exhaust gasses coming from the fuel cell stack is integrated." (Andel, claim 4). While this states that an after burner is part of, or integrated with, a fuel cell system, claim 4 of Andel clearly does not teach or even suggest that the after burner is "disposed at least partially within [a] cavity and between adjacent fuel cell stacks."

Thus, the combination of Elangovan and Andel also clearly fails to teach or suggest the claimed combustor "disposed at least partially within said cavity and between adjacent fuel cell stacks."

Moreover, neither reference teaches or suggests that "a flow of reactant through said fuel cell stacks is in a direction counter to a direction in which said excess exhaust fuel flows to said catalytic combustor such that a heat generation profile in said catalytic combustor is opposite that in said fuel cell stacks such that operation of said catalytic combustor normalizes a temperature profile along a length of said fuel cell stack assembly." There is absolutely no teaching or suggestion in the prior art of record of this subject matter.

Under the analysis required by *Graham v. John Deere*, 383 U.S. 1 (1966) to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in view of the ordinary skill in the art. In the present case, the scope of the prior art, as evidenced by Elangovan, Deshpande and Andel, clearly did not include the claimed combustor "disposed at least partially within said cavity and between adjacent fuel cell stacks" or the claimed "flow of reactant through said fuel cell stacks is in a direction counter to a direction in which said excess exhaust fuel flows to said catalytic combustor."

These differences between the prior art and claimed subject matter are terribly significant because the claimed features provide for normalization of a temperature profile along a length of a fuel cell stack assembly to increase efficiency in a manner not contemplated by the scope of the prior art of record. Specifically, the claimed subject matter provides "a heat generation profile in said catalytic combustor [that] is opposite that in said fuel cell stacks such that operation of said catalytic combustor normalizes a temperature profile along a length of said fuel cell stack assembly." This is entirely outside the scope of the prior art of record. For at least these reasons, no combination of Elangovan, Deshpande and Andel can support a rejection of claims 1 and 19 under § 103 and *Graham.*

In other words, "[t]o establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). Because the cited prior art fails to teach or suggest that claimed combustor disposed at least partially between adjacent fuel cell stacks or the counter-flow between the reactants of the fuel cell stacks and the combustor, all the current rejections of Applicant's claims should be reconsidered and withdrawn.

Additionally, various dependent claims of the application recite subject matter that is further patentable over the prior art of record. Specific, non-exclusive examples follow.

Claim 3 recites "a cathode air profiling manifold disposed around said fuel cell stacks such that an air flow to said fuel cell stacks is optimized by said air profiling manifold." In contrast, Elangovan teaches that all air is routed to a central plenum (28) between the stacks. There is no profiling manifold disposed around the fuel cells stacks, as claimed, that effects or optimizes air flow to the stacks.

Claim 4 recites "wherein said air profiling manifold comprises an outer skin and an inner profiling skin having a plurality of holes enclosing said fuel cell stacks." Similar subject matter is recited in claim 29. This subject matter is not taught or suggested by the prior art of record.

Claim 58 recites "further comprising an excess cathode air router coupled to an end of said fuel cell stack assembly." This subject matter is not taught or suggested by the prior art of record.

For at least these additional reasons, the rejection of each of the claims discussed above should be reconsidered and withdrawn.

Claims 8 and 9 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Elangovan with Deshpande or Andel and U.S. Patent App. Pub. No. 2002/0102445 Senner ("Senner"). This rejection is respectfully traversed for at least the following reasons.

Claim 8 recites "further comprising a flame arrestor in fluid communication between a distal end of said fuel cell stacks and said catalytic combustor." While Senner teaches a flame arrestor in combination with a combustor (paragraph 0041), this is irrelevant since Elangovan and the other cited references teach fuel reformers rather than combustors. Once it is understood that Elangovan and the other prior art teach reformers for preparing, not burning, fuel, it is unmistakably clear that one of skill in the art would not attempt to use the flame arrestor taught by Senner with the reformer taught by Elangovan.

Consequently, the proposed combination of Elangovan and Senner would never have been considered by one of skill in the art and clearly does not render obvious the subject matter of claim 8. For at least these reasons, the rejection based on Elangovan and Senner should be reconsidered and withdrawn.

Claims 13, 24-30 and 35 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Elangovan, with Deshpande or Andel, and U.S. Patent No. 3,044,284 to Kratzenberger ("Kratzenberger"). This rejection is respectfully traversed for at least the reasons given above with respect to the patentability of the independent claims.

Claim 24 is alternatively rejected under 35 U.S.C. § 103(a) over the combined teachings of Elangovan, with Deshpande and Andel, This rejection is respectfully traversed for at least the reasons given above with respect to the patentability of the independent claims.

Claims 14, 15 and 36 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Elangovan, with Deshpande or Andel, and U.S. Patent No. 5,525,311 to Girod et al. ("Girod"). This rejection is traversed for at least the following reasons.

Claim 14 recites "wherein said catalytic bed has a catalytic profile varying between a higher catalytic coefficient at a distal end of said catalytic combustor and a lower catalytic coefficient at a proximal end." Claim 36 recites similar subject matter. The recent Office Action concedes that Elangovan does not teach or suggest this subject matter. (Action of 6/19/07, p. 25).

The Office Action argues the Girod teaches "reaction zones having different temperature profile or gradient attributed to catalyst variation." (Action of 6/19/07, p. 25). Assuming,*arguendo*, that this is an accurate statement of what Girod teaches, this is still not a teaching of the claimed subject matter. The Office Action fails to indicate how or where Girod teaches or suggests "a catalytic profile varying between a higher catalytic coefficient at a distal end of said catalytic combustor and a lower catalytic coefficient at a proximal end."

Consequently, the Office Action has failed to demonstrate how or where the cited prior art teaches the subject matter of claim 14. For at least these additional reasons, the rejection based on Elangovan, with Deshpande or Andel, and Girod should be reconsidered and withdrawn.

Claims 37-39 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Elangovan and U.S. Patent App. Pub. No. 2004/0157096 to Peterson ("Peterson"). This rejection is respectfully traversed for at least the same reasons given above with respect to the independent claims.

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Conclusion:

For the foregoing reasons, the present application is thought to be clearly in condition for allowance. Accordingly, favorable reconsideration of the application in light of these remarks is courteously solicited. If the Examiner has any comments or suggestions which could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the number listed below.

Respectfully submitted,

DATE: August 15, 2007

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